4th TICOSONDE WORKSHOP

Thursday, March 26, 2009, 8:30 AM - 5:30 PM

at

Universidad Nacional,
Campus Omar Dengo, Heredia, Costa Rica
Room 2, Biblioteca Joaquín García Monge

Organizers: *Dra. Jéssica Valverde-Canossa, LAA-UNA*
Dr. Henry Selkirk, NASA GSFC
Geog. Mauricio Zamora, PRIAS-CENAT

SCIENTIFIC PROGRAM

4th TICOSONDE WORKSHOP

8:30 - 9:00 AM **Welcome/Introduction - Ticosonde Accomplishments**

8:30 AM	Dra Jéssica Valverde-Canossa, LAA, UNA
8:35 AM	MSc. Wilberth Jiménez Marin, Director de la Escuela de Ciencias Ambientales, UNA
8:40 AM	Dra. Luisa Castillo, Vicerrectora de Investigación, UNA
8:50 AM	Mr. Timothy Lattimer, Embajada de EEUU – Ticosonde and international scientific cooperation

9:00 - 10:30 AM **1: The SHADOZ and CFH Balloonsonde Program**

9:00 AM	Dr. Henry Selkirk, NASA-GSFC/UMBC – The Ticosonde/SHADOZ balloonsonde project: Four years of water vapor and ozone observations over Costa Rica and opportunities for the future
9:30 AM	Ms. Jacquie Witte - NASA GSFC – Overview and highlights from the Southern Hemisphere Additional Ozonesondes (SHADOZ) Project
10:00 AM	Sr. Victor Hugo Beita, UNA: Ticosonde ozone measurements over Costa Rica as an important tool to study the influence of volcanic emissions
10:15 AM	Srta. Diana Gonzáles, UNA – Evaluation of the seasonal variation of water vapor at the tropical tropopause

10:30 – 11:00 AM Break

11:00 – 2:30 PM **2: Results from Recent Observational Campaigns**

11:00 AM	Dr. Jorge Amador, UCR - The Intra-American low-level jet and tropical cyclone activity
11:30 AM	Dr. Darrel Baumgardner - UNAM - Studies of the variations of tropospheric ozone en relation to lightning in tropical latitudes: Barbados, Houston, Mexico and the Gulf of Mexico

12:00 – 1:30 PM Lunch

1:30 AM	Dr. Alfonso Pino Graell, Univ. of Panamá – Behavior of some TC^4 atmospheric parameters measured by sondes and NASA aircraft
2:00 PM	Sr. Marcial Garbanzo, UCR – Variability of the free atmosphere over Costa Rica during the summers of 2004-2007 and winter of 2006
2:15 PM	Berny Fallas, ICE – Review of weather conditions during the NASA TC^4 mission

2:30 – 5:15 PM **3: Enhancing Climate Observations in Costa Rica**

2:30 PM	Dr. Amando Leyva Contreras, UNAM – Ground-based aerosol measurements in Mexico
3:00 PM	Sr. Sebastián Miranda, UNA – Variation on the SO_2 flux in the plume of the Turrialba Volcano according to data collected by NOVAC instruments, May 2008-February 2009
3:15 PM	Srta. Kristel Heinrich - Aerosol and lidar observations in Costa Rica and the National Climate Program

3:30 – 4:00 PM Break

4:00 PM	Lic. Erick Rivera, UCR – Relevant features of the 2008 climate in Central America and the Caribbean
4:15 PM	Dr. Jorge Andrés Diaz - UCR – The ULISES Project: The use of *in situ* and remote sensing instrumentation for the study of gaseous emissions at active volcanoes and in urban areas
4:30 PM	Dra. Jessica Valverde – The oxidizing capacity of the atmosphere: H_2O_2 and organic peroxide measurements in a tropical wet forest in Costa Rica and their contribution to the HO_x budget
4:45 PM	CENAT – Actual and future projects
5:00 PM	Workshop summary and action items for future work (Dr. Henry Selkirk, leader)

5:15 PM **End of Workshop**

5:30 PM **Publication discussion – Investigators, students**

1: The SHADOZ and CFH Balloonsonde Program

The Ticosonde/SHADOZ Balloonsonde Project: Four years of water vapor and ozone observations over Costa Rica and opportunities for the future

Henry Selkirk[1], Jéssica Valverde-Canossa[2] and Holger Vömel[3]

[1]GEST/UMBC, NASA Goddard Space Flight Center, USA, [2]LAA-EDECA, Universidad Nacional, Costa Rica, [3]Deutscher Wetterdienst, Germany

(Contact: Henry.B.Selkirk@nasa.gov)

Presenter: Dr. Henry Selkirk

In the summer of 2004 with the Ticosonde/NAME radiosonde campaign at Juan Santamaria International Airport, NASA partnered with the Instituto Meterológico Nacional, the Universidad de Costa Rica, the Universidad Nacional, CeNAT in the first of what has become a highly successful series of sustained measurements of the vertical structure and variability of the tropical atmosphere. Balloonsonde measurements of water vapor and ozone using the Cryogenic Frostpoint Hygrometer (CFH) and electrochemical cell (ECC) ozonesondes began in July 2005 during the NASA Tropical Cloud Systems and Processes (TCSP) airborne mission in Costa Rica. These measurements, in concert with NASA's Southern Hemisphere Additional Ozonesondes (SHADOZ) program, have since continued, both on an intensive campaign basis as well as regularly-scheduled launches.

The CFH instrument is recognized as a reference instrument for in situ water vapor measurements in the troposphere and the lower stratosphere, and the Ticosonde/SHADOZ CFH data record from Costa Rica, together with the corresponding ECC ozonesonde profiles, now represent the longest-running record of reliable water vapor measurements in the tropics and have provided key validation data for water vapor measurements on the NASA Aura and Aqua satellites as well as for intercomparison with airborne in situ instruments in two NASA field missions based at San José.

High frequency and high-resolution radiosonde measurements have now been made in five Ticosonde campaigns with nearly 1000 launches. Four of these intensive (4X daily) campaigns took place during the northern summer season when Costa Rica lies within the Intertropical Convergence Zone. Time-height cross-sections of the winds and temperatures during each of these campaigns from 2004-2007 show coherent variability in the tropical tropopause layer (TTL) and above due to westward propagating waves forced by regional deep convection in the ITCZ. We have been able to show with the radiosonde, CFH water vapor data and ECC ozonesonde data that the modulation of tropopause temperatures by these

waves can lead to tropopause dehydration through adiabatic lifting.

The Ticosonde/SHADOZ ozonesonde profiles have also at times been strongly affected by SO_2 in the plume of Volcan Turrialba, and we have found that affected profiles consistent with plumes of SO_2 detected by the Aura satellite OMI instrument. We look forward to adopting a technique developed by Prof. Gary Morris of Valparaiso University to provide more quantitative measurements of volcanic plume SO_2 from the sondes, in collaboration with OVSICORI at UNA and the OMI science team.

Ticosonde data are not only critical in satellite data validation, but they are beginning to be being used in efforts to improve the quality of numerical simulations in atmospheric general circulation models, as well as increasingly in chemistry climate models (CCMs). The particular challenge in CCMs is to achieve a proper balance of dynamics and chemistry in the TTL and this impacts can impact the models' convective and microphysical parameterizations, chemistry codes and transport numerics.

The ongoing CFH/ECC launch program presents other unique opportunities for Costa Rica to make important contributions to climate science and the important task of monitoring the global atmosphere with ground-based measurements. NASA has expressed some interest in partnering with ICE in sun photometry and micropulse lidar (MPL) measurements of aerosols and clouds as part of its AERONET and MPLNET programs. Data from a Costa Rican MPL could be used to establish the existence of thin and even subvisible cirrus in the upper troposphere for comparison with water vapor saturation date derived from concomitant CFH measurements. Another important step forward would be to establish Costa Rica as a tropical site in the WMO's GCOS Reference Upper Air Network (GRUAN). As the only tropical site currently with an ongoing CFH launch program, Costa Rica is well positioned to make an important contribution to the world effort to understand climate change.

Overview and Highlights from the Southern Hemisphere Additional Ozonesondes (SHADOZ) project

Jacquelyn Witte[1], Anne M. Thompson[2] (SHADOZ PI) and the SHADOZ Team

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(Contact: Jacquelyn.Witte@nasa.gov)

Presenter: Jacquelyn Witte

Advances in tropospheric ozone data products being developed for tropical and subtropical regions using Total Ozone Mapping Spectrometer (TOMS) and the current Ozone Monitoring Instrument (OMI) onboard NASA's Aura spacecraft have continued to motivate efforts to renew and expand the collection of balloon-borne ozonesondes observations. NASA's Southern Hemisphere ADditional Ozonesondes (SHADOZ) project is a web-based archive established in 1998. It's goals are to support validation of satellite ozone measurements, improve remote sensing techniques for estimating tropical and subtropical ozone, and provide a database for process studies and model validation. Profile data are taken from balloon-borne ozonesondes, currently at 12 stations coordinating weekly to bi-weekly launches. Station data are publically available at a central location via the internet: <http://croc.gsfc.nasa.gov/shadoz>. Data also includes measurements from various SHADOZ supported field campaigns, such as, the Indian Ocean Experiment (INDOEX), Sounding of Ozone and Water in the Equatorial Region (SOWER), Aerosols99 Atlantic Cruise, and the most recent CR-AVE mission in Panama (July/August 2007). We highlight some of the accomplishments and applications of the SHADOZ database, such as, 1/ the establishment of baseline tropical trends and seasonality, 2/ the validation the wave-one in the tropics, 3/ ongoing satellite validation studies, 4/ improvements to model run assimiliations, 5/ improvements in sonde intercomparisons studies (Balloon Experiment on Standards for Ozone Sondes [BESOS]), and 6/ decerning high-resolution features in the Quasi-bienniel Oscillations (QBO) in ozone in the lower stratosphere.

TICOSONDE ozone measurements over Costa Rica as an important tool to study the influence of volcanic emissions

V. Beita-Guerrero[1], J. Valverde-Canossa[1]; H. Vömel[2]; H. Selkirk[3]; D. González[1]; S. Carvajal[1]; J. Arce[1]; S. Carn[4]; J. Herrera[1], R. Susana[1]

[1]Laboratorio de Análisis Ambiental, Universidad Nacional, Heredia, Costa Rica, [2]Deutscher Wetterdienst, Germany
[3]GEST/UMBC, NASA Goddard Space Flight Center, USA, [4]University of Michigan, USA

(Contact: jvalverde25@gmail.com)

Presenter: Victor Hugo Beita-Guerrero

In Costa Rica there are ~250 volcanic structures, i.e. volcanoes, caldron, volcanic necks, maars. They belong to so called Pacific Rim of Fire. From these structures five are active volcanoes and three of them are close to the Central Valley: Poás, Irazú, and Turrialba. Costa Rica has ~4.2 million inhabitants of which about two-thirds live in the Central Valley. Due to their location, height and meteorological factors these volcanoes represent a significant threat to the human and animal health and the environment. One of the main gases emitted by volcanoes is SO_2, and exposure to high levels of this gas is known to produce respiratory and cardiovascular illness which is enhanced on people with asthma or chronic lung or heart disease. It also damages trees and crops, and together with nitrogen oxides it is one of the main precursors of acid rain. SO_2 also is implicated in the formation of acid aerosols in the m range, which are known to have serious health implications as well as contributing to climate change.

Vertical profile measurements of ozone have been made weekly at Alajuela, Central Valley, Costa Rica (10.22°N, 83.13°W, 883.5 m a.s.l) by balloon-borne electrochemical concentration cell (ECC) ozonesondes which reach altitudes of about 30 km. Though these measurements are intended to measure ozone, they are also sensitive to the presence of SO_2 because SO_2 interferes with the normal chemistry of the electrochemical cell (ECC) method for ozone detection, with the net result being that each molecule of SO_2 registers as minus one molecule of O_3. Since the launches began in July 2005 and up to the present, episodes of high SO_2 concentrations (>20 ppbv) have been observed, with a peak in frequency and magnitude in 2007. Though Poas and Irazú volcanoes are the closest to the Central Valley we attribute the presence of this SO_2 mainly to the Turrialba volcano. In the last 3 years Turrialba volcanoe has increased its seismic activity and fumarole emissions and the plume has shown significant changes in its chemical composition. Prevailing easterlies disperse the plume on the Central Valley. OMI SO_2 data also confirms this showing the Turrialba plume moving westward in the direction of Alajuela.

Evaluation of the seasonal variation of water vapor at the tropical tropopause

D. González[1]; J. Valverde-Canossa[1]; H. Vömel[2]; H. Selkirk[3]S. Carvajal[1]; V. Beita-Guerrero[1]; J. Arce[1]; J. Herrera[1], R. Susana[1]

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Presenter: Diana González

Since 1980 the stratospheric water vapor has tended to increase but in 2001 it decreased suddenly and has remained at lower levels since then. The reasons and processes involved in these changes are unknown. Therefore it is critical to study the processes that take place in the tropical upper troposphere/lower stratosphere region since it is the source for most of the stratospheric air and thus its humidity. The tropical tropopause plays a key role in controlling the transport of water vapor between the troposphere and stratosphere. In order to better understand the role of the tropopause in the transport of water vapor, this study is focused on the seasonal cycle and interannual variability of this important trace species. Vertical profile measurements of water vapor, ozone and physical parameters (i.e. pressure, temperature, humidity, wind velocity and direction) have taken place at Alajuela, Costa Rica (10.22°N, 83.13°W, and 883.5 m a.s.l) by balloon-borne Cryogenic Frostpoint Hygrometer (CFH), Electrochemical Concentration Cell (ECC) ozonesondes and standard radiosondes respectively. Regular water vapor launches began in July 2005 and are currently conducted monthly with soundings typically reaching altitudes of 30 km. We observed that typical tropopause temperatures are -80 ºC to -87 ºC from December and April and -76 ºC to -82 ºC from June to September. A similar behavior was observed in the mixing ratio of water vapor where typical concentrations are 2 ppmv to 4 ppmv from December and April and 3 ppmv to 7 ppmv from June to September. It is also observed that throughout the year the water vapor mixing ratio at the tropopause is correlated to the temperature.

2: Results from Recent Observational Campaigns

THE INTRA-AMERICAS LOW-LEVEL JET AND TROPICAL CYCLONE ACTIVITY

Jorge A. Amador
Center for Geophysical Research and School of Physics, University of Costa Rica, San Jose, Costa Rica

Presenter: Jorge A. Amador

A relevant climate feature of the Intra-Americas Sea (IAS) is the low-level jet (IALLJ) dominating the IAS circulation, both in summer and winter; and yet it is practically unknown with regard to its nature, structure, interactions with mid-latitude and tropical phenomena, and its role in regional weather and climate. This paper deals with the IALLJ current knowledge and its contribution to IAS circulation–precipitation patterns and presents recent findings about the IALLJ based on first in situ observations during Phase 3 of the Experimento Climático en las Albercas de Agua Cálida (ECAC), an international field campaign to study IALLJ dynamics during July 2001. Nonhydrostatic fifth-generation Pennsylvania State University National Center for Atmospheric Research Mesoscale Model (MM5) simulations were compared with observations and reanalysis. Large-scale circulation patterns of the IALLJ northern hemisphere summer and winter components suggest that trades, and so the IALLJ, are responding to land–ocean thermal contrasts during the summer season of each continent. The IALLJ is a natural component of the American monsoons as a result of the continent's approximate north–south land distribution. During warm (cold) El Niño-Southern Oscillation phases, winds associated with the IALLJ core (IALLJC) are stronger (weaker) than normal, so precipitation anomalies are positive (negative) in the western Caribbean near Central America and negative (positive) in the central IAS. Stronger (weaker) than normal IALLJC winds during warm (cold) ENSO events imply a stronger (weaker) than normal vertical wind shears in the Caribbean, a condition known to inhibit (allow) deep convection and tropical cyclone activity. During the ECAC Phase 3, strong surface winds associated with the IALLJ induced upwelling, cooling down the sea surface temperature by 1–2º C. The atmospheric mixed layer height reached 1 km near the surface wind maximum below the IALLJC. Observations indicate that primary water vapor advection takes place in a shallow layer between the IALLJC and the ocean surface. Latent heat flux peaked below the IALLJC. Neither the reanalysis nor MM5 captured the observed thermodynamic and kinematic IALLJ structure. So far, IALLJ knowledge is based on either dynamically initialized data or simulations of global (regional) models, which implies that a more systematic and scientific approach is needed to improve it. The Intra-Americas Study of Climate Processes (IASCLIP) is a great regional opportunity to address trough field work, modeling, and process studies, many of the IALLJ unknown features.

Key words: Intra-Americas low-level jet; tropical cyclone activity; El Niño-Southern Oscillation (ENSO)

Studies of the variations of tropospheric ozone en relation to lightning in tropical latitudes: Barbados, Houston, Mexico and the Gulf of Mexico.

Darrel Baumgardner
Centro de Ciencias de la Atmósfera – UNAM, Universidad Nacional Autónoma de México

Presenter: Darrel Baumgardner

As part of the INTEX Ozonesonde Network 2006 Study (IONS-06) thirty ozonesondes were launched from the Central de Ciencias de la Atmósfera (CCA) at the Universidad Nacional Autónoma de México, in the southwest sector of Mexico City, in August and September of 2006. Vertical profiles of ozone, temperature and relative humidity were measured up to altitudes that usually exceeded 30 km. These measurements are complementary to those that were made during the same period at 22 other locations in the United States and Canada.

The analysis compares the profiles of ozone made in the tropical latitude of Mexico City (19° N, 99°W) with those made at mid and high latitudes and evaluates the relationship of these profiles to lightning frequency and intensity in nearby regions.

Behavior of Some TC-4 Atmospheric Parameters Measured by Sondes and NASA Aircrafts

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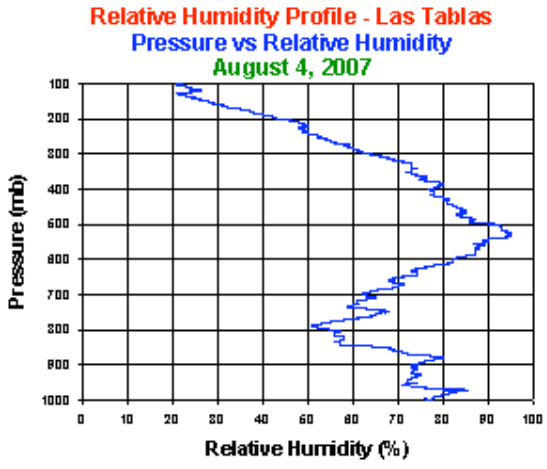
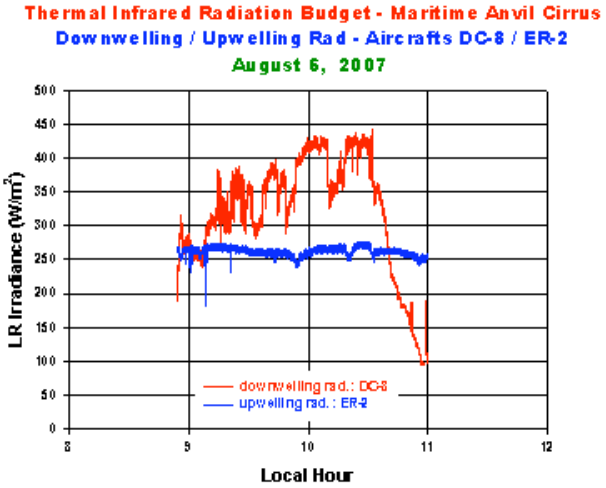
Presenter: Prof. Alfonso Pino Graell

The Laboratory of Atmospheric Physics of the University of Panama collaborated with NASA TC-4 field campaign during July and August, 2007. To study the profiles of some atmospheric parameters, sondes were launched twice daily from San José, Costa Rica and Las Tablas, Panama. One of these parameters is relative humidity whose daily vertical structure is associated with tropical deep convection. Relative humidity behavior through upper troposphere and lower stratosphere is very important in order to assess the contribution of water vapor to climate change, since water vapor is the most powerful greenhouse gas. Relative humidity, temperature and ozone profiles obtained from data collected with sondes launched from Panama and Costa Rica, during TC-4, are analyzed. Relative humidity profiles show inversion layers near 550 mb which are linked with deep convection processes occurred previously. Radiative forcing from maritime anvil cirrus plays an important role in the modulation of climate change, since these clouds have a cooling effect as a consequence of scattering incoming sunlight by cirrus ice crystals. But these clouds also have a warming effect due to the fact that they absorb upwelling thermal infrared radiation emitted from the surface. During TC-4, several coordinated flights of ER-2 (over the cirrus layer) and DC-8 aircrafts (below the cirrus layer) were planned. A discussion of the incoming solar radiation budget as well as the thermal infrared radiation budget measured during the coordinated flights occurred on August 6, 2007, will be presented.





Variability of the Free Atmosphere over Costa Rica during the Summers of 2004-2007 and Winter of 2006

Marcial Garbanzo Salas

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Presenter: Marcial Garbanzo Salas

During the summers of 2004-2007 and the winter of 2006 NASA airborne field campaigns were carried out from Juan Santamaria Airport (09 59 N, 82 42 W) Costa Rica. Four radiosondes per day were launched at 00:00, 06:00, 12:00 and 18:00 GMT for periods from 1 to 2.5 months. The data were collected at 2-sec intervals. The radiosondes used were RS80-15G, RS90-AG, and RS92-SGP. The data collected have been processed in order to study the vertical structure of the atmosphere up to ~30 km in temperature, potential temperature, relative humidity, equivalent potential temperature, saturated equivalent potential temperature, and wind. The research that is being carried out will allow, among other aspects, to determine the diurnal variation of the planetary boundary layer, the characteristics at the beginning and end of the "veranillo" phenomenon during the summer rainy season, soundings associated with severe weather, and comparison of the characteristics of "El Niño" and "La Niña" years. Here some findings of the research, illustrated with examples, are presented. The analysis of the data is in progress but some examples are given here in time-height diagrams for the winter of 2006 and summer 2007, periods coinciding with the Costa Rica-Aura Validation Experiment (CR-AVE) and NASA TC^4 (Tropical Composition, Cloud and Climate Coupling) missions.

Review of weather conditions during TC^4 mission

Berny Fallas

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Presenter: Berny Fallas

On latest NASA Mission in Costa Rica (TC4), weather conditions played an important role due to its relevance on local weather conditions at Juan Santamaría Airport, that were crucial for the timings of take off and landings of the planes used on the mission, furthermore, it was important to locate spots of scientific interest, as invest areas with deep convection and/or cirrus. This talk tries to make a review of the main weather features on July and August, when TC^4 experiments were done.

3: Enhancing Climate Observations in Costa Rica

The sites AERONET-UNAM "Mexico City" and "Hermosillo" in the Mexican Republic. A brief review of their characteristics and their information on the atmospheric aerosol of their respective zones of monitoring activity

Amando Leyva Contreras

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Presenter: Amando Leyva Contreras

The site Aeronet "Mexico City" was installed and put in operation in March of 1999. Its central objective is the roboticized monitoring of the system of suspended particles (SPS) in a zone with important urban and industrial development, high indices of contamination and an intense and constant development of the population, and urban activities, in the Metropolitan Zone of the Mexico Valley. The site "Hermosillo", installed and put in operation and November of 2001 in the campus of the University of Sonora, in the city of Hermosillo, state of Sonora, it is located in a desert zone, the Desert of Sonora, climatologically defined by its geographic position within the boreal latitudinal belt of the high pressures. In spite of their intrinsic dryness, the NW of the Mexican Republic sees intensified this characteristic thanks to the proximity with respect to the Cold Current of California, that maintains reduced rates of oceanic evaporation and reduced the humidity contribution toward the near continental region. In this site, important challenges for our work group are pending. One of them: to collect sufficient data to explain the mechanisms by means of which the SPS interacts with the regionally prevailing time systems: tradewinds, winds of the east, the jetstream, and, of singular relevance, the North American Monsoon System (NAMS), to form the cloud cover and the precipitation regime in the NW Mexican region.

Variation on the SO_2 flux in the plume of the Turrialba Volcano, according to the data collected by NOVAC instruments, from May 2008 to February 2009.

S. Miranda[1], B.Galle[2], E. Duarte[1], E. Fernandez[1], D. Rojas[1], A. Mata[1], H. Villalobos[1], V. Conde[3], M. Johansson[2], C. Rivera[2]

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Presenter: Sebastián Miranda

NOVAC is a recently started project, funded by the European Union in 2005, with the aim to establish a global network of stations for the quantitative measurement of volcanic gas emissions, especially SO_2. The network is based on the Scanning Dual-beam mini-DOAS. As part of this project, four DOAS stations were installed in Costa Rica around Turrialba Volcano at the end of April 2008. This volcano was selected due to its recent reactivation, accessibility and high increasing levels of the SO_2 Flux since 2001. For example, in that year the SO_2 flux was 1 ton/day approximately, while in August 2007 the SO_2 flux was higher than 61 ton/day.

Since January 2008 the sulfur dioxide flux increased. For example, from May to November of that year the monthly SO_2 flux average calculated was between 651 and 2120 ton/day, although from December 2008 to February 2009 the activity of Turrialba Volcano has decreased. The monthly SO_2 flux average for this period was around 250 ton/day. Sulfur dioxide emissions have had a major impact on environment around the volcano, especially on the west flank. This was the prevailing plume direction during this period and it is possible that there was formation of acid rain, resulting in the burning of vegetation in the area.

Key words: Turrialba Volcano, NOVAC project, DOAS stations and SO_2 flux.

Costa Rica's National Climate Change Strategy: Technological MRV through ultraviolet, aerosol, and LIDAR observations

Kristel Heinrich

National Meteorological Institute, Climate Change Program March, 2009
(Contact: kheinrich@imn.ac.cr)

Presenter: Kristel Heinrich

The Bali Action Plan towards a post-2012 climate regime, year when the United Nations Framework Convention on Climate Change's (UNFCCC) Kyoto Protocol expires, states four action pillars as key elements which must be concreted in order to ensure adequate emissions reductions by all Parties in years to come, as recommended by the Intergovernmental Panel on Climate Change (IPCC). Specifically, the four building blocks of the Bali Action Plan are mitigation, adaptation, financing, and technology transfer from Annex I Parties to developing countries. All actions on mitigation, and likely all actions on the other tree pillars (giving the state of the negotiations to the Conference of the Parties in December 2009 in Copenhagen) must be properly measurable, reportable, and verifiable (MRV) in order to be accepted by the UNFCCC.

Costa Rica has voluntarily and unilaterally taken the international commitment to becoming carbon neutral by the year 2021, on the bicentennial of its independence, thus gaining international recognition. Thus, the National Climate Change Strategy (NCCS) was created around the equally important National and International Agendas. The National Agenda has been defined around six strategic axes or components, the main of which are Mitigation and Adaptation; the other four transversal components are: Metrics, Capacity Building and Technology Transfer, Education, Culture and Public Awareness, and Financing. The International Agenda is also structured around six strategic components, the key of which are Exert International Influence and Attract Foreign Resources. Leadership, Legitimacy, Presence in Multilateral and Binational Forums, and International Capacity Building are the other four components which, similarly to the National Agenda, are transversal and complimentary within the Strategy.

Projects such as lidar aerosol measurements and ultraviolet measurements through the Ticosonde ozonesonde program are crucial to actively develop measurable, reportable, and verifiable climate change science which will allow to envision the local threats of this global problem. This new torrent of hard scientific data will strengthen support to the twelve pillars of the NCCS such as access to new international financial mechanisms and concrete public awareness material.

RELEVANT FEATURES OF THE 2008 CLIMATE IN CENTRAL AMERICA AND CARIBBEAN

Jorge A. Amador[1,2], Eric J. Alfaro[1,2], Erick R. Rivera[1], and Blanca Calderón[1]

[1]Center for Geophysical Research and [2]School of Physics, University of Costa Rica, San José, Costa Rica

Presenter: Erick Rivera

Under current climate change scenarios, climate monitoring becomes a key issue to planning activities focused on the reduction and amelioration of societal impacts caused by a changing climate. This work aims at identifying 2008 climate anomalies with respect to climate mean (1971-2000) for the most relevant climate features affecting Central America and the Caribbean. Daily mean temperature and daily precipitation for a set of stations, on both slopes of Central America for 2008, were used to compare their climatology with corresponding values for that particular year. Gridded NCEP/NCAR data were used to analyze 2008 wind anomalies over the Caribbean, a region dominated by the Intra-Americas Low-Level Jet (IALLJ), in the context of El Niño-Southern Oscillation (ENSO) cold phase of 2008. Also, sea surface temperature indexes for the Tropical North Atlantic (TNA) and Niño 3 regions were used to study its relationship with the IALLJ wind anomalies. The Mid-Summer Drought (MSD) or "veranillo" for the selected sites along the Pacific slope of Central America was investigated by using precipitation pentad distribution. A brief discussion of the 2008 cold outbreaks and cyclone activity in both the Caribbean and eastern tropical Pacific is presented. All selected stations along the Pacific slope showed a decrease in the 2008 mean surface temperature, the opposite being true for most Caribbean slope stations. Rainy season for Central America evolved in a way consistent with the presence of La Niña event and the meridional migration of the ITCZ. The MSD, a characteristic of the annual cycle of precipitation in Central America, was well defined along the Pacific side of this region. Wind anomalies associated with the IALLJ were larger (smaller) than normal during February (July) 2008, consistent with earlier findings in regards to the relationship of the IALLJ and ENSO phases. Cold outbreaks for 2008 were near the normal frequency (16) for the period 1971-2001. The year of 2008 was very active for tropical storm formation in the Caribbean basin (lat < 24º N, lon > 60º W). From 16 named storms observed in the Atlantic, 10 entered the Caribbean basin. Eight (five) Atlantic cyclones were hurricanes (strong hurricanes) and from the five hurricanes crossing the Caribbean basin, four were strong.

Keywords: Intra-Americas Low-Level Jet, Mid-Summer Drought, ENSO phases

The ULISES Project: The Use of *in situ* and Remote Sensing Instrumentation for the Study of Gaseous Emissions at Active Volcanoes and Urban Areas

Dr. Jorge Andrés Díaz

Professor, Escuela de Física. FM 430., Head. Gas Sensing Lab. CICANUM. Universidad de Costa Rica, Co- PI. TICOSONDE Project

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Presenter: Dr. Jorge Andrés Díaz

The start of the ULISES project is presented to the TICOSONDE forum, as the spearhead for the development of a platform for in-situ and/or local data acquisition, and to compare it with data taken with satellites and airborne platforms for remote sensing instrument validation and calibration.(Ground Truth Validation).

The project seeks to use sensor-based instruments for the continuous monitoring and visualization of volcanic and urban areas gas emissions, through the development of mass spectrometry, complemented with electrochemical sensors, optical and compared with those taken with remote sensors.

A key milestone for this project was the signature early this year of a Technical Assistance Agreement (TAA) with NASA at the Kennedy Space Center. Part of the action plan is to participate in the International Symposium on Remote Sensing for Environment (ISRSE 33) to be held in coming May in Stresa, taly.

The project seeks to integrate advanced and graduate students for conducting seminars and graduation thesis, and hopes to lay the groundwork for starting collaborations with other national academic institutions and to establish international research collaborations.

Oxidizing capacity of the atmosphere: H_2O_2 and organic peroxides measurements at a tropical wet forest in Costa Rica and their contribution to the HO_x budget

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Measurements of H_2O_2 and organic hydroperoxides in the tropical forest are fundamental to help understand the reactivity of biogenic volatile organic compounds (BVOC) at low NO_x. The central roles of HO (hydroxyl radical), HO_2 (hydroperoxyl radical) and RO_2 (peroxy radical) in the troposphere have long been recognized. Recently HO_x radicals (HO_x = HO + HO_2) have been measured in unexpected high concentrations under conditions characterized by high concentrations of BVOC and low levels of nitrogen oxides (NO_x = NO + NO_2). The comparison of measurements with model results showed that, based on present understanding of the chemistry, HO concentrations are underestimated by factors of 5-10, evidencing a "missing" source for HO. Preliminary laboratory and model analyses have shown that measurements of H_2O_2 and organic peroxides can provide key information to help resolve the discrepancy. Therefore we propose an integrated approach consisting of laboratory experiments, measurement of peroxides and other trace gases in the tropical forest in Costa Rica and modelling investigations in order to improve our understanding concerning the reactivity of BVOC at low NOx and the HOx (HOx = HO + HO_2) system.